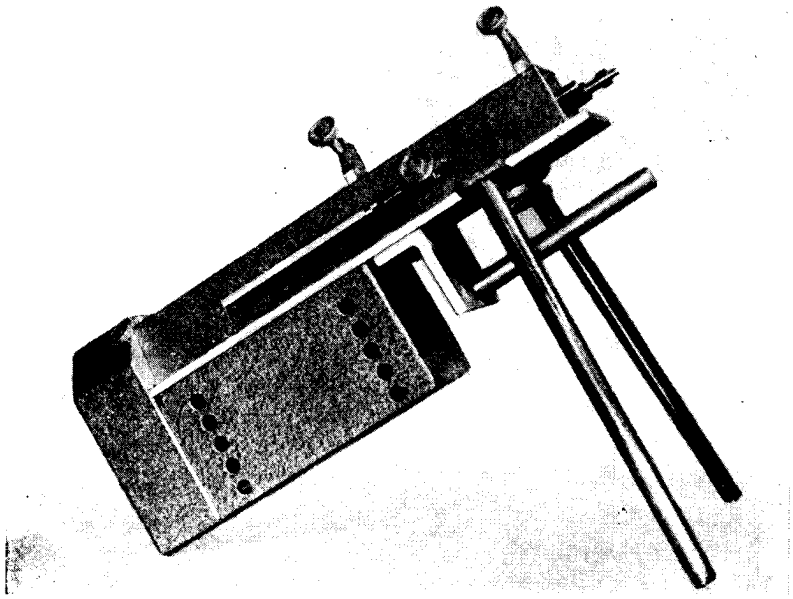
Automatized Apparatuses for Biochemical Laboratories

The tendency to automatize procedures, excluding the occurrence of objective errors and providing possibilities to utilize free time after working hours is a characteristic feature of biochemical research today. Some of the separation processes require continuous operation of the apparatus.

In the Czechoslovak Academy of Science the development and production of instruments for automation in laboratory processes is concentrated in the Instrument Development Workshops.

The development of the apparatus is carried out in collaboration with leading scientific workers of the Institute of Organic Chemistry and Biochemistry, and its individual stages are checked in this Institute. Original designs have already been published in scientific journals[1—4, 6].

Those apparatuses were selected from an extensive group of items pertaining to automation in laboratory processes which proved satisfactory in laboratory practice from 1960 to 1961 and are especially designed for research in biochemistry.



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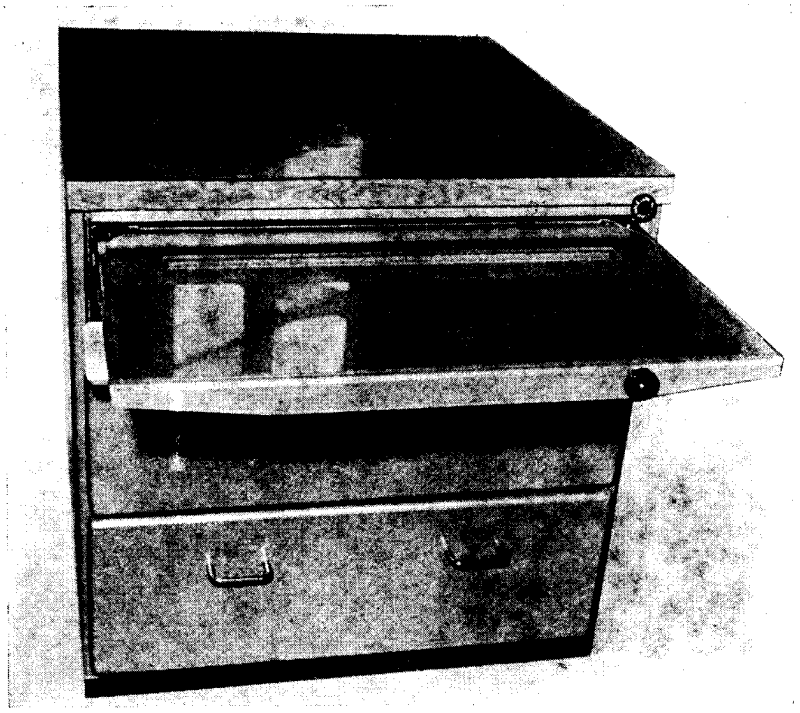
9009 LINEAR FEEDING DEVICE

is designed for the slow continuous feeding of small volumes of liquid injected from a pre-filled syringe. Standard syringes of different sizes can be used. The feeding device is provided with a quick-break switch closing the power supply to the motor as soon as the syringe piston reaches the preset position. The speed of the piston stroke is adjustable by means of interchangeable gears. An accessory of the delivering device is a set of 12 gear wheels permitting the adjustment of both the reduction gearing and the accelerating gearing at 12 different speeds. The apparatus is particularly suitable for feeding components into reaction mixtures, for contact processes and column chromatography.



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9037 CHROMATOGRAPHIC BENCH-

ensures the quick and clean spotting of samples on the paper in paper chromatography practice. The operation is mechanized. The working table is equipped with internal screws permitting the attachment of stand rods, a draw-out spotting table with drier, troughs used for dipping chromatograms to be detected and a storage cabinet for paper.

9076 STANDARD LABORATORY MICROPUMP

designed for pumping liquids free of mechanical contaminants and gas bubbles. Under these conditions and provided the press-

ure does not exceed 2.5 atp. the fed volume per unit of time is constant. The volume of liquid to be fed can be adjusted up to a maximum of approximately 1200 ml. per hour.

The actual pump part can be easily disassembled by loosening two hand-screws if cleaning, sterilization, *etc.* is required. The micropump has become a necessary item in chromatographic fractionations on columns, as it ensures an entirely constant flow of the liquid even when the inner resistance of the column varies. Apart from these processes it has also been utilized in the technique of organic chemistry for metering components into reaction mixtures, *etc.*

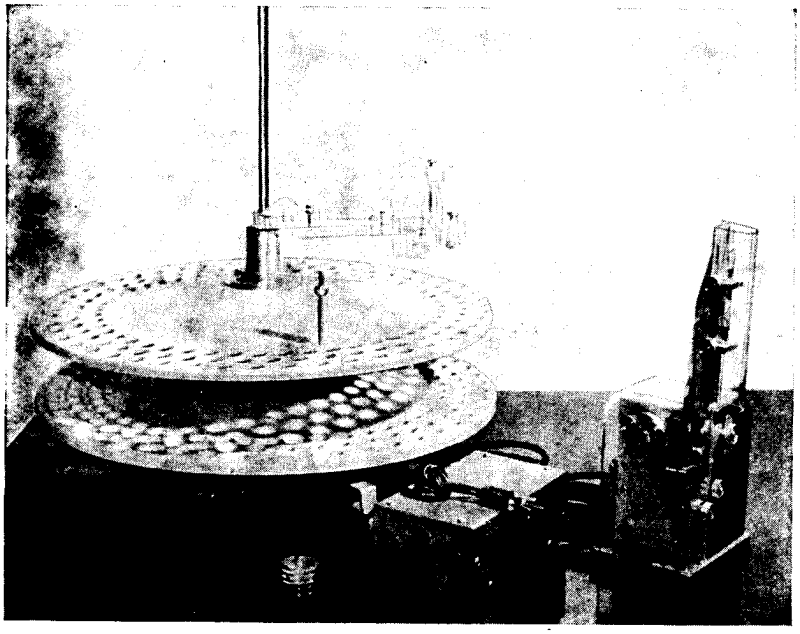
Special accessories supplied at request are the timer (Type No. 0084) controlling the collector (Type No. 0080), a six-way cock (Type No. 0128), through-flow micropipettes (Type No. 1011), *etc.*

0080 FRACTION COLLECTOR

used for fractionations on columns consists of the following:
turntable (Type No. 0080)
standard laboratory micropump (Type No. 9076)
micropump time switch (Type No. 0084)
combined power and control unit (Type No. 0082)
attachment for filling several circular rows of the fraction collector (Type No. 083).

An attachment for preparative-scale collection (Type No. 0183) is supplied as a special accessory. The quantity of the sample to be collected into each individual test tube corresponds to the number of strokes of the micropump piston; after a preset number of strokes the gearing mechanism is actuated and the table rotated over a distance corresponding to the space between one test tube and the next. The turntable accomodates 3 circular rows of 48 tubes each.

The device for filling several rows automatically switches the effluent delivery tip after the completion of one complete turntable revolution so that all 144 tubes may be utilized in one experiment.



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0133 ATTACHEMENT FOR PREPARATIVE-SCALE COLLECTION

contains a three piece bottle holder and a device which enables the gradual filling of three circular rows of bottles. Its maximum capacity is 96 bottles 250 ml. each, *i.e.* 24 l. of eluate.

0127 ULTRAMICROPUMP

for the pumping and exact measurement of very small volumes of liquids (from 50 to 2500 ml. per hour, max. several tens of ml. per 24 hours). The actual pumping unit is made of a chemically and thermally resistant and stable material. The volume to be pumped can be adjusted with precision over a wide range.

The ultramicropump, when connected to an ion-exchange microcolumn, a spotting drum and, if necessary, a six-way cock forms an assembly which enables the separation of complex mixtures on an analytical scale.

0137 AUTOMATIC ELECTROPHORESIS

for the separation of small amounts of substances on paper, applicable to both low- and high-molecular compounds. It is designed for research work in physico-chemical, radiological, biochemical, biological and clinical laboratories. In addition to its analytical application, paper electrophoresis is also utilized in preparative-scale experiments. The chief advantage of the apparatus lies in the possibility of presetting the whole cycle of operations. After the apparatus has been switched on, the whole cycle of operations proceeds automatically without the need for any supervision as is especially advantageous in experiments

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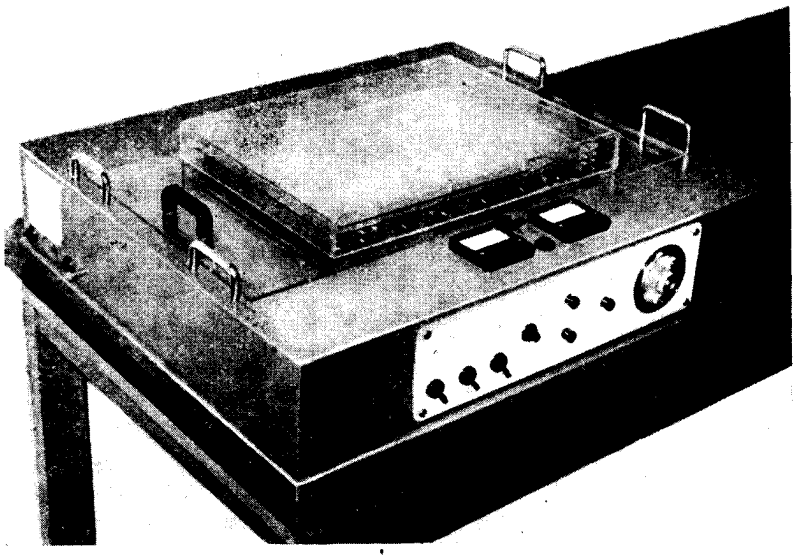

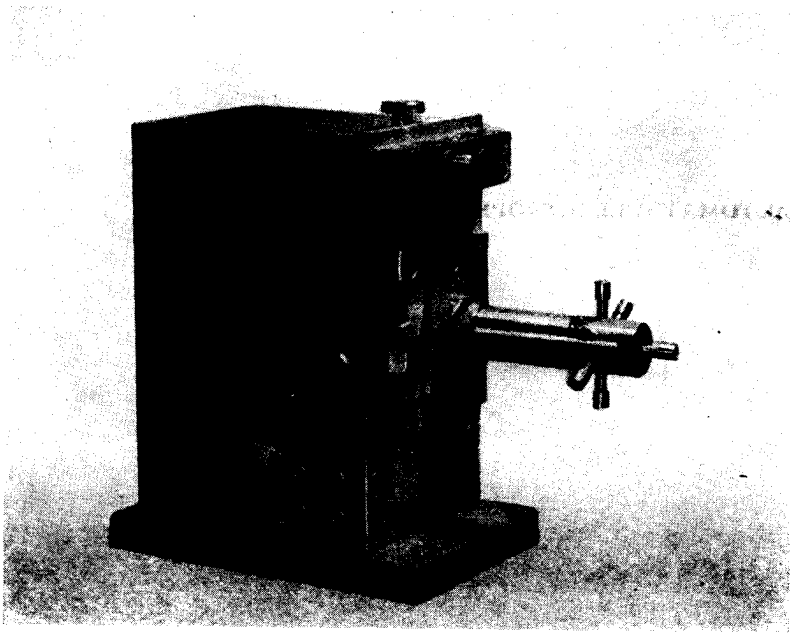

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with radioisotopes where any contamination must be excluded. The apparatus is equipped with a D. C. power supply unit (max. 600 volts and 300 mAmp.) with push-button switches, a timer, voltage and current controls and signal pilot lamps. The apparatus enables the setting of the actual time of electrophoresis from 0—10 hours, the drying interval of 0—2 hours, followed by switching off the apparatus. When handling or uncovering the glass plate, the apparatus is switched off automatically thus excluding any possibility of electric shock. The troughs with platinum electrodes can be removed for the cleaning of the inner chamber.

0128 SIX-WAY COCK

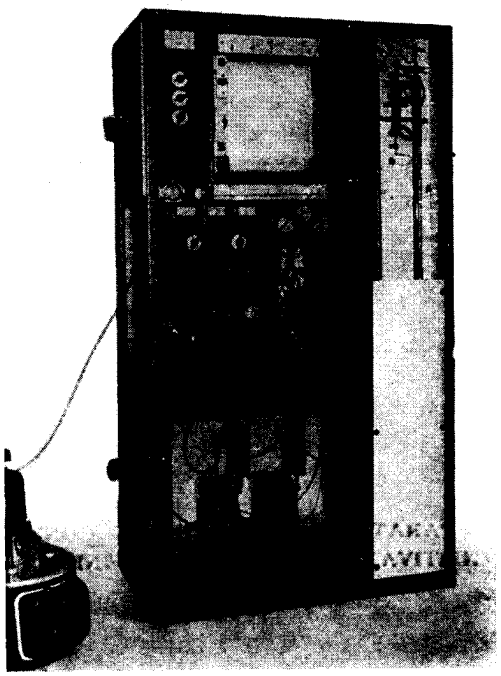
The six-way cock can be used where a gradual supply of liquid from six reservoirs into one piping or, from one piping into six

reservoirs is required. The switching to individual sections of the piping is automatic, controlled by an electric impulse, both short-time (0.5 sec. approx.) or permanent. In both cases the cock is turned by 60°. The six-way cock is especially suitable for chromatographic column operations if a stepwise gradient or, when connected with the mixing device, an exactly continuous gradient is required. The electric impulse can be controlled by the timer of the micropump (Type No. 0084).

9015 AUTOMATIC AMINO ACID ANALYZER

is an analytical apparatus of our own design, based on the principle of Spackman *et al*[5].

The apparatus performs one cycle of complete amino acid



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analysis and the regeneration of columns within 24 hours. The working conditions are entirely automatized, the micropumps of our own design are easily regulated and work reliably.

1011 DRUM SPOTTING DEVICE WITH A THROUGH-FLOW MICROPIPETTE

The through-flow micropipette is a device which based on a time principle, supplies exact small volumes of liquid. If connected to the effluent tip of the chromatographic column, it removes at regular intervals aliquots of the eluate (*e.g.* 5 μl) and doses them for analytical evaluation. If connected to the drum spotting device it continuously withdraws exact amounts of the eluate of the column, to be analyzed by paper chromatography.

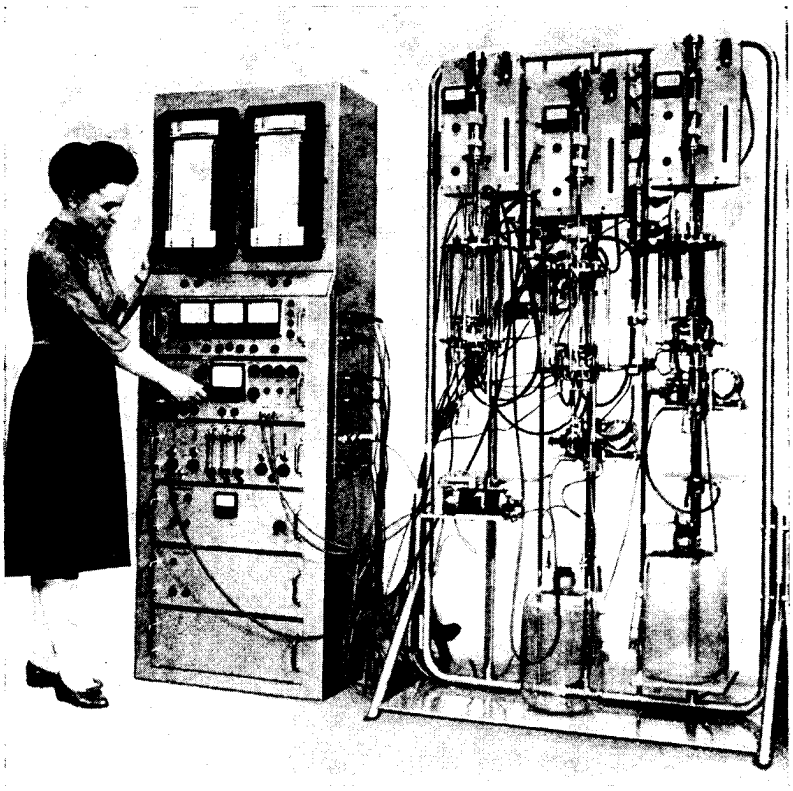
The micropipette is controlled by impulses from the time switch of the spotting drum or the micropump (Type No.0084).

The drum spotting device permits the continuous application of liquid on chromatographic paper. The drum is rotated at a speed which can be regulated; the drying of the liquid is achieved by an air stream. Two sheets of chromatographic paper fastened to the drum will last for 48 hours of operation. The registration of the eluate of the column washed out with volatile buffers is used for two-dimensional paper chromatography. The spotting drum may be used either as a part of the assembly consisting of the six-way cock (Type No. 0128), the ultramicropump (Type No. 0127), the analytical microcolumn and the spotting drum or merely for the branching off the column effluent tube (in preparative runs) connected to the through-flow micropipette.

The drum spotting device is driven by its own motor and is equipped with a time switch which can be used for the control of further instruments.

0001 APPARATUS FOR BATCH AND CONTINUOUS FLOW CULTIVATION OF MICROORGANISMS

The whole device is composed of two main units, the cultivating unit and the regulation and registering unit. The cultivating unit



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comprises a stand and three cultivating sub-units. The sub-units are independent and can operate either in parallel or, in processes involving several steps, they can be connected in series, either with identical or different operating volumes of the media. The sub-unit is composed of the cultivating vessel, the stirrer drive, the air-inlet control, the pump supplying nutrient medium and an auxiliary device. The regulation unit contains three temperature regulators (an independent regulator for each cultivating sub-unit) and 3 regulators controlling the supply of anti-foaming agents.

The regulation unit further contains 3 nephelometers for continuous flow turbidity measurements (except for fibrous organisms). It also accomodates a regulation and registration pH-meter equipped with an automatic switch for three measuring sites.

References

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Instrument Development Workshops

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Czechoslovak Academy of Science